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THE MYODOCOPID OSTRACOD FAMILIES PHILOMEDIDAE AND PSEUDOPHILOMEDIDAE (NEW FAMILY)

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Introduction

The Pseudophilomedidae, new family, is represented in the oceans of the world by only one genus, *Pseudophilomedes* Müller, 1894, containing 4 species: 2 in the Mediterranean Sea (Müller, 1894), 1 in the eastern Atlantic (Brady and Norman, 1896), and 1 in the western Atlantic (Kornicker, 1959).

The writer recently received 17 specimens of *Pseudophilomedes ferulanus* Kornicker, 1959, as part of a collection of ostracods obtained by Dr. John H. Day from the Atlantic Shelf off Beaufort, N.C. Four additional specimens from the same area were in a collection made in 1964 by personnel on the U.S. Bureau of Commercial Fisheries R/V *Gosnold*. This material has been used to supplement 3 specimens collected from the Great Bahama Bank, upon which the original description was based (Kornicker, 1959).

I have taken this opportunity to review the genus. Specimens of *Pseudophilomedes foveolatus* Müller, 1894, the type species of *Pseudophilomedes*, were borrowed from the Zoological Museum, Berlin, and the original description by Müller (1894) is supplemented in this paper.

Specimens identified by Brady and Norman (1896) as males of

Pseudophilomedes foveolatus Müller (called *Philomedes foveolata* by Brady and Norman) were borrowed from the collection of the British Museum. It is concluded that they are not congeneric with *Pseudophilomedes* but instead are members of the genus *Euphilomedes* Poulsen, 1962. They are identified as *Euphilomedes asper* (Müller, 1894) and *Euphilomedes* sp. and are described and illustrated in this paper. A supplemental description is given of a syntype of *Euphilomedes asper* (Müller) borrowed from the Zoological Museum, Berlin.

As a result of this study, the subfamily *Philomedinae* Müller, 1912, has been raised to familial rank.

I wish to thank Dr. John H. Day of the Beaufort Marine Laboratory, Duke University, and personnel of the U.S. Bureau of Commercial Fisheries for specimens of *Pseudophilomedes ferulanus* from the Atlantic Shelf, and Dr. J. P. Harding for permission to study specimens in the collection of the British Museum (Natural History), identified as *Philomedes foveolatus* (Müller) by Brady and Norman (1896), and Dr. H. E. Gruner for permission to study syntypes of *Pseudophilomedes foveolatus* Müller and *Philomedes asper* Müller in the collection of the Zoological Museum, Berlin. I wish also to thank Miss Caroline Bartlett Gast for preparing plates for publication from my penciled camera lucida drawings and especially for the carefully stippled drawing of the ventral view of *P. ferulanus* (fig. 1). Criticisms of the manuscript by Mr. I. Gregory Sohn and Doctors Raymond B. Manning, Thomas E. Bowman, and Meredith L. Jones are greatly appreciated.

Discussion of Classification

Classification of myodocopid Ostracoda was reviewed by Skogsberg (1920) and more recently by Poulsen (1962). Of particular concern in the present paper are the taxonomic relationships of *Pseudophilomedes*. Therefore, discussion of classification will be restricted to the superfamily, Cypridinacea Baird, 1850. When Müller (1894) described *Pseudophilomedes*, he referred it to the family *Cypridinidae* Baird, 1850. Two years later, Brady and Norman (1896) described the genus *Paramekodon* (=*Pseudophilomedes*) referring it also to the *Cypridinidae*. Later, Müller (1912) established the subfamily Philomedinae in the Cypridinidae. He referred to the Philomedinae the genera *Philomedes* Liljeborg, 1853, *Pseudophilomedes*, and *Rutiderma* Brady and Norman 1896. Skogsberg (1920) recognized the Philomedinae for *Pseudophilomedes* and *Philomedes* but followed Brady and Norman (1896) in placing *Rutiderma* in the Rutidermatidae Brady and Norman, 1896. The Philomedinae *sensu* Skogsberg has been recognized by Sylvester-Bradley (1961), Poulsen (1962, 1965), and

Hartmann (1964). However, Poulsen (1962, p. 339) perceived that *Pseudophilomedes* might require a higher ranking in the classification:

> . . . according to the description the two genera [*Paramekodon* Brady and Norman, 1896, and *Pseudophilomedes* Müller, 1894] hold a rather unique position in the family Cypridinidae (and in the Rutidermatidae and Sarsiellidae) by having only two endites on the maxilla. Also in the reduced number of bristles on the basale and endopodite of the mandible and by the reduced 1st and 2nd endites and the end-joint of the 6th limb the two genera differ widely from all other Cypridinidae. If further investigations should confirm these differences these two genera may well have to be included in a family of their own.

After reviewing the genus *Pseudophilomedes* I find that I concur with Poulsen; therefore, I have established the new family Pseudophilomedidae. The genus *Pseudophilomedes* Müller, 1984, with its synonym *Paramekodon* Brady and Norman, 1896, is referred to the Pseudophilomedidae.

Müller (1912, p. 33) considered *Paramekodon* Brady and Norman, 1896, to be a synonym of *Pseudophilomedes* Müller, 1894. Skogsberg (1920, p. 348) agreed with Müller and stated: "In the identification of *Paramekodon* with *Pseudophilomedes* Müller certainly is correct." Sylvester-Bradley (1961, p. 399) also considered *Paramekodon* to be a synonym of *Pseudophilomedes*. Poulsen (1962, p. 339) was of the opposite opinion and stated: "If the description of *Paramecodon* [sic] is reliable, it is based on a single specimen conserved dry, the species differs in so many respects from *Pseudophilomedes* that the uniting of the two genera into one—as done by G. W. Müller is hardly admissible."

Differences between *Pseudophilomedes* and *Paramekodon* seem quite minor; therefore, I have followed Müller (1912), Skogsberg (1920), and Sylvester-Bradley (1961) in considering *Paramekodon* to be a synonym of *Pseudophilomedes*. Of possible significance in this regard is the following statement by Brady and Norman (1896, p. 623) in their publication in which the genus *Paramekodon* was established:

> It was not until our Monograph was nearly completed, and on the point of going to press, that there appeared the splendid work of Herr. G. W. Müller on the Ostracoda of the Gulf of Naples. This work has, in the case of some few species, anticipated our descriptions, and we have, as far as possible, rectified our nomenclature in conformity with it. For the rest we have thought it best to let our MS. go to press as it was originally written.

It was in the work mentioned in the above statement that Müller established the genus *Pseudophilomedes*. It is unfortunate that Brady and Norman did not have more time to study Müller's paper before publishing their monograph. The fact that they wrongly considered a species of *Philomedes* to be males of *Pseudophilomedes foveolatus* Müller, 1894, shows that they held a misconception of the

morphology of *Pseudophilomedes*. The fact that they state (1896, p. 660) that in their opinion *Pseudophilomedes* is not sufficiently different from *Philomedes* to warrant the establishment of a new genus and, then, on page 670 establish the new genus *Paramekodon* for precisely the same reason Müller established *Pseudophilomedes* must be attributed to confusion resulting from the unexpected publication of Müller's work.

Brady and Norman (1896, p. 665) described a new species, *Streptoleberis favosa* Brady and Norman, 1896, collected at depths of 836 to 2333 meters off the west coast of Morocco. From 2 dried specimens they were able to examine only fragments of appendages. Concerning the 2nd antenna, Brady and Norman (loc. cit.) commented: "The antennae resemble most closely in character the same organs in *Paramekodon*, having no appendicular branch but two setae in its place, the basal joint somewhat smaller than usual, the length exceeding the breadth, first joint of the swimming branch rather slender." Fragments of the furca were illustrated by Brady and Norman (ibid, pl. 62, figs. 20, 21). The distribution of strong and slender claws on the lamella is similar to that of the genus *Pseudophilomedes* and also to some species in the genus *Euphilomedes* Poulsen, 1962. Claw no. 1 of the furca has a large tooth near the middle of the convex margin and bears short spines between the tooth and the tip of the claw. The claw is quite similar to claw no. 1 on species of *Pseudophilomedes*. *Streptoleberis favosa* is probably closely related to *Pseudophilomedes* and may belong in that genus. *Streptoleberis crenulata* (Brady, 1890), the type species of the genus, is known only from its shell and belongs in the category "genera dubia et species dubia" (Müller, 1912, p. 15; Poulsen, 1965, p. 44). *Streptoleberis rectirostris* Brady and Norman, 1896, the third species that has been referred to *Streptoleberis*, is also known only from the shell and Müller (1912, pl. 51) correctly considered it as a species dubia.

At the present state of our knowledge there seems little reason for considering the present subfamily Philomedinae to be more closely related to the Cypridininae than to other subfamilies comprising the Cypridinacea. Therefore, the subfamily Philomedinae is raised to familial rank. Some distinguishing characters between females of the Philomedidae and Pseudophilomedidae are as follows:

	Philomedidae	*Pseudophilomedidae*
Shell, no. of medial bristles behind rostrum	6+	4–5
1st ant. 2nd joint, no. of bristles	2–3	1
2nd ant. endop., no. of joints	1–2	1
2nd ant. endop., no. of bristles	6+	2–4
2nd ant. exop. 9th joint, no. of bristles	4–7	2–3
Mandible, basale, no. of medial plus ventral bristles	10+	4
Mandible, endop. 2nd joint, no. of dorsal bristles	8+	4

(Continued)	*Philomedidae*	*Pseudophilomedidae*
Maxilla, no. of endites	3	2
Maxilla, end joint with process (p) or only spines (s)	s	p
5th limb, no. of endites	3	1?
5th limb, 2nd joint with extremely long fanglike tooth (f) of with shorter tooth (s)	s	f
6th limb, no. of endites	4	3–4
6th limb, end joint, no. of bristles	9–45	7–9
7th limb, terminal with comb opposed by 2 pegs (p) or 2 opposing combs (c)	p	c

Skogsberg (1920), Poulsen (1962, 1965), and Hartmann (1964) are correct in considering the families Rutidermatidae Brady and Norman, 1896, Cylindroleberidae Müller, 1906 (= Asteropidae Brady, 1874), and Sarsiellidae Brady and Norman, 1896, to have coordinate rank. In view of the anatomy of the male *Rutiderma*, recognized for the first time by Poulsen (1965), referral of the genus *Rutiderma* to the Sarsiellidae as done by Sylvester-Bradley (1961) seems no longer tenable. Thus, the families contained in the superfamily Cypridinacea are: Cypridinidae Baird, 1850; Philomedidae Müller, 1912; Rutidermatidae Brady and Norman, 1896; Cylindroleberidae Müller, 1906; Sarsiellidae Brady and Norman, 1896; Pseudophilomedidae, new family.

Key to Families of Cypridinacea

1. Well-developed gills * along posterior of body, protopodite of maxilla elongate with row of ventral bristles . . . . . Cylindroleberidae
   Without both well-developed gills and elongate protopodite on maxilla . . . 2
2. Mandible of female with large pincers distally . . . . . Rutidermatidae
   Mandible without large pincers 3
3. Fifth limb of female with large teeth 4
   Fifth limb of female without large teeth . . . . . Sarsiellidae
4. Maxilla with only 2 stout endites . . . . . Pseudophilomedidae
   Maxilla with 3 endites 5
5. Lamellar prolongation of selvage with fringe of hair . . . . Philomedidae
   Lamellar prolongation of selvage without fringe of hair . . . . Cypridinidae

* Gills are common to all Cylindroleberidae but are rare in the Cypridinidae.

Pseudophilomedidae, new family

Philomedinae Müller, 1912, p. 24 (part).

Type genus.—*Pseudophilomedes* Müller, 1894.

Diagnosis (female; male unknown).—Shell: Oval in lateral view with rostrum and posterior process. Antennal sinus varies from shallow curvature to deep incisure. Punctate surface smooth or with longitudinal ridges or medial sulcus. Inner lamella with 4 or

5 bristles in row behind rostrum and 1–6 bristles dorsal to posterior process. Lamellar prolongation of selvage with fringe of hairs along anterior and neutral margins of shell.

First antenna: First joint without bristles; 2nd joint with 1 dorsal bristle; 3rd joint with 1 ventral and 1 dorsal bristle; 4th joint with 1 distodorsal and 2 distoventral bristles; 5th joint with 1 distoventral bristle having short terminal filaments; 6th joint reduced, with a short distomedial bristle; 7th joint reduced, with 1 short a-bristle with spines, 1 medium b-bristle, and 1 long c-bristle; 8th joint reduced, with 2 long bare d- and e-bristles and 2 long f- and g-bristles. Sensory bristle on 5th joint, b- and c-bristles of 5th joint, and f- and g-bristles of 8th joint with forked tips and few ringed filaments.

Second antenna: Endopodite single jointed with 1 long hirsute bristle and 1–3 short bare bristles. Exopodite with 9 joints: 2nd to 8th joints each with 1 long bristle; 9th joint with 2–3 bristles.

Mandible: Coxale endite bifurcate at tip. Basale with 4 ventral and 3 dorsal bristles. Exopodite elongate with 2 terminal bristles. Endopodite: 1st joint with 1–4 bristles; 2nd joint with 3–4 dorsal bristles, and 2–3 ventral bristles; end joint with 1 long claw, 2 shorter claws, and about 3 bristles.

Maxilla: Precoxale endite with 3 stout pectinate spines and 2–3 bristles; coxale endite with 2 stout pectinate spines and 2 bristles. Endopodite with slender to stout terminal process.

Fifth limb: Second joint prolonged distally forming long fanglike tooth followed along the inner margin by 3 teeth. Inner margin of protopodite with single endite with 1–2 bristles. Epipodial appendage with numerous bristles.

Sixth limb: End joint with 7–9 bristles; endites 3–4 in number, not more than 1 bristle in place of epipodial appendage.

Seventh limb: Terminus with opposing combs. Number of bristles in distal group 4–6, in lateral group 2–8; total number of bristles 6–14.

Frontal organ: Elongate with or without(?) rings proximally.

Eyes: Large medial eye and small lateral eyes.

Furca: Third claw more slender than 4th. Total number of claws 6–10; all well-developed claws separated from lamella by suture.

Distribution.—Atlantic Ocean off Morocco, on Great Bahama Bank, B.W.I., on Continental Shelf off North Carolina and Georgia, U.S.A., Gulf of Naples (Mediterranean Sea).

Ecology.—The family is benthonic. It has been reported from water with temperatures ranging from about 3° to 29° C., water depths of 6 to 1435 meters, and salinities from about 35 to 38 parts per thousand. Specimens have been collected from shelly sand, sandy mud, and calcareous algae. Some environmental factors concerning each species are presented in table 1.

TABLE 1.—*Environmental factors concerning each species*

Species	Depth meters	Temp. °C.	Salinity °/oo	Location	Reference
P. inflatus (Brady and Norman, 1896)	1435	3*	normal marine*	Atlantic Ocean off Morocco	Brady and Norman, 1896
P. foveolatus Müller, 1894	100*	14–15*	36–38*	Gulf of Naples	Müller, 1894; Puri, 1963; Puri, Bonaduce, Malloy, 1964
P. angulatus Müller, 1894	100*	14–15*	36–38*	Gulf of Naples	Müller, 1894; Puri, 1963; Puri, Bonaduce, Malloy, 1964
P. ferulanus Kornicker 1959	6	29	37	Great Bahama Bank	Kornicker, 1959
	80–160	15–21. 4	normal marine	Atlantic shelf off North Carolina	present paper
	43–131		ca 35	Atlantic Shelf off Georgia	Darby, 1964

*Depth, temperature, and salinity are estimates based on general environment of sample locality.

TABLE 2.—*Locality and environmental data of Atlantic Shelf samples*

Sample Station Numbers	Latitude	Longitude	Date	Depth m	Type Bottom	Sediment Temperature °C*	Sampler Type	Number of Specimens
Gosnold Sta. 1857	34°18.7′N	76°00.1′W	June 26, 1964	85			Campbell grab	1
Gosnold Sta. 1817	34°00.0′N	77°14.4′W	June 23, 1964	28			Campbell grab	1
Gosnold Sta. 1877	36°30.9′N	74°46.0′W	June 27, 1964	96			Campbell grab	2
Beaufort Shelf Trans. 30	34°19.6′N	75°56.8′W	April 6, 1965	130	sandy mud	20	VanVeen grab	6
Beaufort Shelf Trans. 55	34°19.5′N	75°56.3′W	April 6, 1965	160	sandy mud	22	VanVeen grab	4
Beaufort Shelf Trans. 102	34°26′N	75°56.5′W	June 28, 1965	80	shelly sand	21. 4	dredge for 10 minutes	1
Beaufort Shelf Trans. 108	34°23.5′N	75°54′W	June 28, 1965	122	shelly sand	15. 0	dredge for 10 minutes	1
Beaufort Shelf Trans. 155	34°23.0′N	75°53.7′W	Sept. 30, 1965	160	sandy mud	19. 5	VanVeen grab	5

*Bottom temperature obtained by thrusting a thermometer into the substrate as soon as it was taken out of the VanVeen grab or dredge.

Pseudophilomedes

Pseudophilomedes G. W. Müller, 1894, p. 211.
Paramekedon Brady and Norman, 1896, p. 670.

TYPE SPECIES.—*Pseudophilomedes foveolatus* Muller, 1894.
GENDER.—Masculine.
DIAGNOSIS.—Same as for family.

Key to Species of *Pseudophilomedes*

(species in brackets not described in present paper)

1. Shell with longitudinal ridges . . . . . [**P. angulatus** Müller, 1894]
   Shell without longitudinal ridges 2
2. Endopodite of 2nd antenna with 2 short bristles
   [**P. inflatus** (Brady and Norman, 1896)]
   Endopodite of 2nd antenna with more than 2 short bristles 3
3. Endopodite of 2nd antenna with 3 short bristles . . . . . **P. foveolatus**
   Endopodite of 2nd antenna with 4 short bristles . . . . . **P. ferulanus**

Pseudophilomedes ferulanus

FIGURES 1–6; PLATE 1

Pseudophilomedes ferulana Kornicker, 1959, p. 235, figs. 46, 1A–B, 2A–B; 56, A–D.—Darby, 1965, pp. 64–70, fig. 10, pls. 11, 12.

HOLOTYPE.—USNM 113287; male; complete dry specimen. Specimens from Atlantic Shelf, 8 specimens: USNM 113020–113022.

MATERIAL.—The number of specimens, locations of sampling stations, and some environmental factors concerning specimens collected from the Atlantic Shelf are presented in table 2. All specimens sufficiently developed for determining sex were females. Five specimens were dissected for this study.

SUPPLEMENTAL DESCRIPTION OF FEMALE (male unknown).—Shell (fig. 3): Oval, highest anterior to center, widest posterior to center; posterior process slightly below middle of valve; rostrum subtriangular with nearly horizontal lower margin; antennal sinus shallow; surface punctate; each valve with arcuate sulcus extending from dorsal margin to near middle of valve; left valve overlaps right valve along anterodorsal and posterodorsal margins; hinge simple, extending from highest point on valve to posterodorsal corner; about 15 muscle scars in front of and below middle of each valve (fig. 3*c*), additional muscles are attached near anterodorsal corner of valve (fig. 3*h*). Inner lamella broadest behind rostrum and in front of posterior projection; radial pore canals numerous (fig. 3*f*); selvage with lamellar prolongation and fringing hairs (fig. 3*g*); inner lamella behind rostrum with row of 4 bristles with short marginal hairs (fig. 3*d*); inner lamella in front of posterior process with row of 6 hirsute setae (fig. 3*e*); inner

lamella below antennal sinus with 1 short bristle; outer surface of each valve with scattered tapered hairs.

Darby (1965 p. 64) states concerning the shell, "About six nodes along the contact margin of both valves slightly dorsal to caudal process." These nodes each contain a hirsute setae, and the nodes are well-defined pores rather than raised structures (pl. 1*i*).

Darby (1965, p. 64) reports 4 or 5 bristles on the inner lamella behind rostrum, indicating variability in the number of bristles in that area; only 4 bristles were observed in the examined specimens.

Shell dimensions (in mm) are as follows (see table 2 for station data):

station	*specimen no.*	*greatest length*	*greatest height*	*greatest width*	*remarks*
BST 30	1	1. 66	1. 16	1. 00	eggs in brood pouch
"	2	1. 30	0. 81		late instar
"	3	1. 54	1. 00		eggs in body
"	4	1. 52	1. 00		eggs in body
"	5	1. 54	0. 96		no eggs
GOS 1857	1	1. 73	1. 15		eggs in brood pouch

First antenna (figs. 4*a–d*): First joint with spines along ventral margin; 2nd joint with dorsal bristle and marginal spines; 3rd joint with 1 ventral and 1 dorsal terminal bristle and marginal spines; 4th joint with 1 subterminal dorsal and 2 terminal ventral bristles; 5th joint with 1 long ventral, terminal sensory bristle with forked tip and 2 proximal, ringed filaments; 6th joint minute and fused to 5th, with 1 short spinous medial bristle; 7th joint reduced and fused to 8th joint, with 1 short spinous a-bristle, 1 medium b-bristle with forked tip and 1 distal filament, and 1 long stout c-bristle with forked tip and 2 proximal filaments; 8th joint reduced, with 2 long bare d- and e-bristles, 1 long f-bristle with forked tip and 3 distal and 1–2 proximal filaments, and 1 long g-bristle with forked tip and 1 distal and 2 proximal filaments; 1st to 4th joints with rows of slender spines on medial surface.

Second antenna (figs. 4*e, f*): Endopodite (fig. 4*f*) single jointed, with long hirsute bristle and 2 short bare bristles. Exopodite (fig. 4*e*) with 9 joints: 1st joint slightly longer than total length of following joints; 2nd to 9th joints trapezoidal, each joint smaller than preceding joints, all without basal spines, 2nd to 8th joints with long bristles, bristle on 2nd joint with spines and natatory hairs, bristles on 3rd to 8th joints with sparse natatory hairs and stout marginal spines near middle; 9th joint with medium spinous bristle and 2 long bristles with natatory hairs; distal margins of 2nd to 8th joints with comb of slender spines. Medial surface and anterior margin of protopodite with clusters of slender spines.

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Mandible (figs. 4*g–i*): Coxale endite (fig. 4*h*) bifurcate, 1 prong annulate, other nonannulate, both with spines, more spines on annulate prong. Basale with 7 bristles, 4 ventral, 3 dorsal. Exopodite with 2 bristles, outer bristle about half length of inner bristle. Endop-

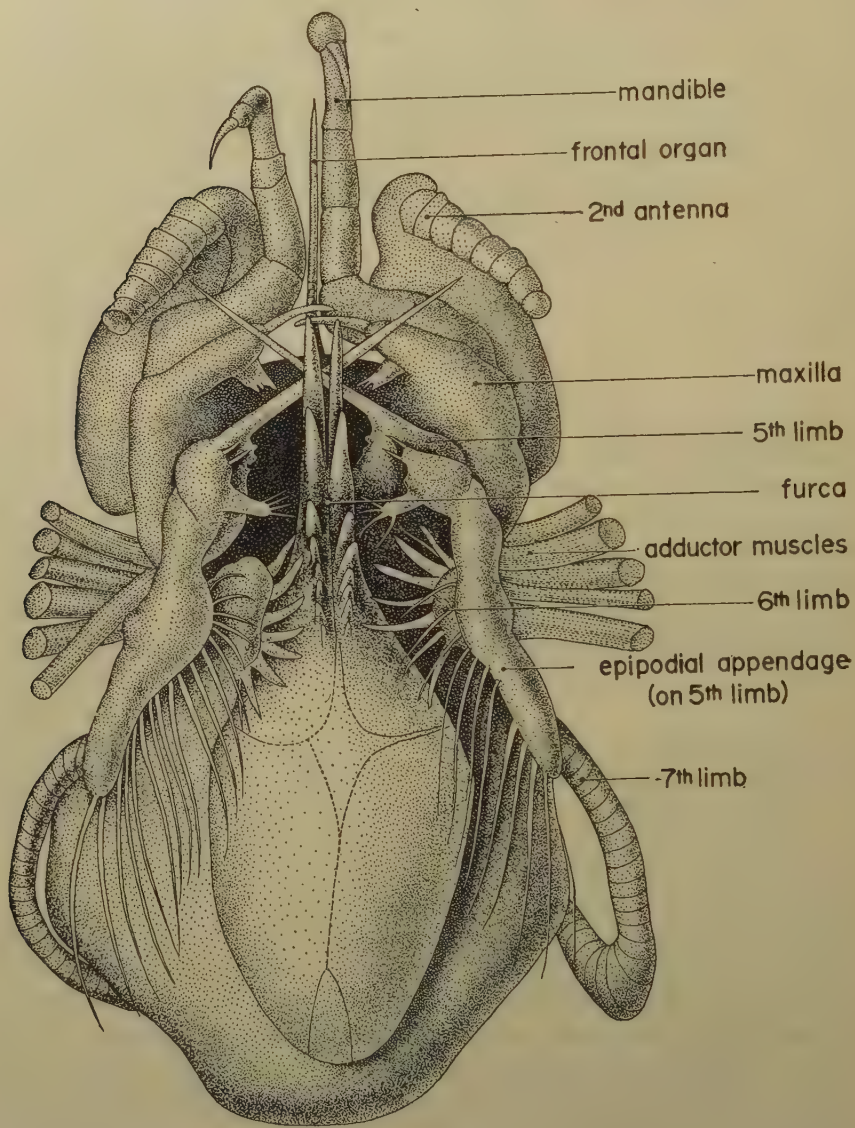

FIGURE 1.—*Pseudophilomedes ferulanus:* ventral view, removed from shell; all bristles, muscles, and appendages not shown; appendages and joint positions generalized. (Spec. 1, Gosnold Sta. 1857.)

odite: 1st joint with 1 short and 2 long ventral bristles distally; 2nd joint with 1 dorsal bristle proximal to middle, 3 dorsal bristles near middle, and 3 short ventral bristles distally; end joint (fig. 4*i*) with 3 bristles and 3 claws, 1 of latter very long, 1 about a third to half length of long claw, 1 on dorsal edge very short. Medial surface of endopodite and basale with clusters of fine hairs.

Maxilla (figs. 1, 5*a–d*): Precoxale endite with 3 stout pectinate

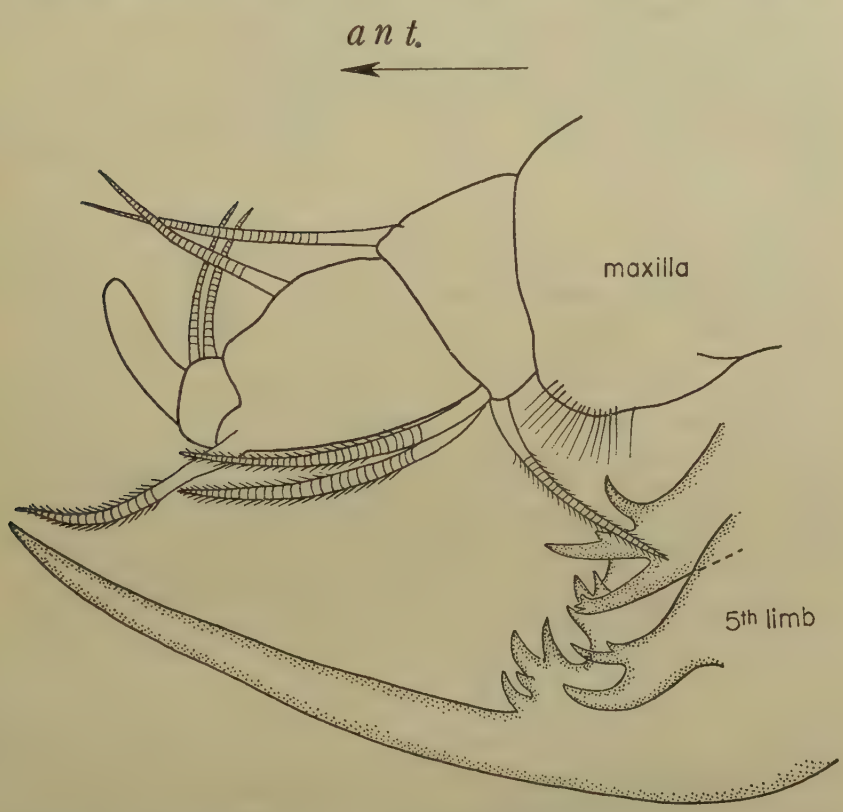

FIGURE 2.—*Pseudophilomedes ferulanus*: lateral view, left maxilla, 5th limb in place; all bristles not illustrated. (Spec. 3, Beaufort Shelf Transect, Sta. 30.)

spines and 2 spinous bristles. Coxale with stout plumose bristle, hirsute epipodial fringe and endite with 2 stout pectinate spines and 2 spinous bristles. Distal edge of basale with 1 spinous medial bristle and 2 on inner margin adjacent to low node with 2 bristles at base of coxale endite, shorter of latter bristles bare, other with several marginal spines. Exopodite consisting of 3 lateral spinous bristles distally on basale (figs. 1, 5*a*). Endopodite: 1st joint hirsute with 2 spinous bristles, 1 near middle and 1 terminally; 2nd joint

with 1 short and 2 long terminal spinous bristles and a long stout process with annulations and a rough surface of small pustules distally.

Fifth limb (figs. 5*e–i*): First joint with 2 large teeth: proximal tooth trident with 3 bristles (fig. 5*f*); distal tooth bifid (fig. 5*h*). Second joint prolonged distally forming long fanglike tooth followed along the inner margin by a single tooth and 2 trident teeth (fig. 5*e*); posterior surface with 2 stout spinous bristles and a minute bristle (fig. 5*i*); inner edge of joint with spinous bristle (fig. 5*i*). (It was not possible to discern with certainty that this bristle was not in fact on a proximal margin of the distal tooth of the first joint.) Third joint with 2 short hirsute bristles (fig. 5*i*). Fourth joint hirsute with 1 short and 2 long terminal bristles and 1 short subterminal bristle (figs. 5*g,i*). Epipodial appendage with 42–46 bristles. Single endite with 2 short bristles.

Sixth limb (fig. 6*a*): First endite with 1 to 2 bristles; 2nd endite with 2 bristles; 3d and 4th endites each with 5 to 6 bristles; end joint with 9 to 10 bristles (end joint of late instar with only 7 bristles); single bare bristle in place of epipodial appendage. Surface with clusters of hairs; end joint fringed with hair.

Seventh limb (figs. 6*b–d*): Symmetrical terminus with opposing combs of 5 or 6 teeth (all teeth not shown in figs. 6 *b,c*). Adult with 6 terminal and 6 to 8 lateral bristles (instars with fewer bristles), each bristle with 1 to 5 bells (fig. 6*d*) and short marginal spines distally. Distribution of bristles on seventh limbs of 4 specimens from station BST 30 are as follows:

	limb A	limb B*
specimen no. 1		
terminal bristles	6	6
lateral bristles	8	7
specimen no. 2		
terminal bristles	4	4
lateral bristles	4	6
specimen no. 3		
terminal bristles	6	lost
lateral bristles	6	lost
specimen no. 4		
terminal bristles	6	6
lateral-bristles	8	7

* Limbs A and B are opposing 7th limbs; they have not been classified as either left or right.

Furca (figs. 6*e, f–h*): Each lamella with 8 to 10 claws; 3rd claw thinner than 4th but about the same length; each claw separated from lamella by suture with exception of 9th and 10th claws which, when present, appear as nodes. Claw 1 with stout spines in row proximally on lateral margin, slender spines distally on lateral and medial margins, 1 large spine near middle of medial margin, and groups of slender

spines distally on anterior surface; claws 2–8 with spines along medial and lateral margins; lamella, in area of distal and proximal claws, with hairs.

Eyes: Median eye (fig. 6*j*) large, pigmented. Lateral eyes (fig. 6*g*) small, black in preserved specimens.

Frontal organ (figs. 6*j*, *k*): Elongate, proximal part divided into about 8 short segments, distal part (fig. 6*k*) tapered, with short spines near terminus.

Eggs (fig. 6*i*): As many as 8 eggs observed in thoracic region; 2 to 6 eggs in brood pouch.

Parasites: Two larval copepods of genus *Sphaeronella* in brood pouch of 1 specimen having eggs inside body (specimen no. 4, Beaufort Shelf Transect 30).

Pseudophilomedes foveolatus

FIGURES 7, 8

Pseudophilomedes foveolata Müller, 1894, pp. 211–212, pl. 3, figs. 34, 35, 45–49, 51, 53, 54; pl. 4, figs. 127. [Not *Philomedes foveolata* Brady and Norman, 1896, pp. 659–661, pl. 56, figs. 4, 5.]

SYNTYPES.—Zoological Museum of Berlin, Division of Crustacea, catalog no. 9154.

MATERIAL.—A vial containing 1 whole specimen and a left and right valve in alcohol was received from the Zoological Museum, Berlin. The accompanying label contained the following information: Kat. Nr, 9154; Species *Pseudophilomedes foveolata* G. W. Müller, 1894; Fudort Neapel. An asterisk appears in the upper left-hand corner of the label.

The small size of the specimens leads me to believe that they are late instars of females. I have designated the whole specimen as specimen number 1 in this paper and on the prepared slide.

DESCRIPTION OF LATE INSTAR OF FEMALE (male unknown).—Shell (figs. 7*a–d*): Lateral outline oval, highest anterior to center; posterior process slightly below middle of valve; rostrum subtriangular with nearly horizontal lower margin; antennal sinus shallow; surface punctate; ovoid muscle scars in front of and below middle of each valve. Inner lamella broadest behind rostrum and in front of posterior projection; selvage with lamellar prolongation and fringing hairs unbroken around antennal sinus; inner lamella behind rostrum with row of 4 bristles with short marginal hairs (fig. 7*b*); inner lamella in front of posterior process with 1 (or 2 closely spaced?) hirsute seta (fig. 7*c*); inner lamella below antennal sinus with 1 short bristle; outer surface of each valve with scattered surface hairs.

Müller (1894, pl. 3, fig. 7) illustrates 4 bristles on the inner lamella behind the rostrum but does not show them to be hirsute. He evi-

dently also overlooked the faint seta on the inner lamella in front of the posterior process and the small bristle below the antennal sinus.

Shell dimensions (in mm) are as follows:

specimen no.	*greatest length*	*greatest height*	*remarks*
1	0. 73	0. 46	whole specimen
2	0. 64	0. 43	separated left valve
3	0. 73	0. 48	separated right valve

Müller (1894, p. 212) gives a length of 0.93 mm for this species. The smaller size of specimens available for the present study indicates that they are instars.

First antenna (figs. 7*e,f*): Second joint with 1 spinous dorsal bristle and sparse clusters of spines on medial surface; 3rd and 4th joints each with 1 ventral and 1 dorsal spinous terminal bristle; 5th joint with 1 long ventral, terminal sensory bristle with forked tip; 6th joint minute, welded to 5th joint, and with 1 short medial bristle; 7th joint reduced, welded to 8th joint, and with 1 short spinous a-bristle, 1 short b-bristle with forked tip and 1 distal filament, and 1 long c-bristle with forked tip; 8th joint reduced, with 2 long bare d- and e-bristles, 1 long f-bristle and 1 long g-bristle, both with forked tips.

The illustration of the 1st antenna illustrated by Müller (1894, pl. 3, fig. 48) bears 2 ventral bristles terminally on the 4th joint (considered 5th joint by Müller). The presence of only 1 bristle in that position on the specimen I examined may be due to its not being adult. A few filaments were observed on long bristles of joints 5–8, but it was not possible to determine the exact number and precisely on which bristles they belonged.

Second antenna (figs. 7*g-i*): Endopodite (fig. 7*h*) single jointed, with 1 long hirsute bristle and 1 short bare bristle. Exopodite with 9 joints: 1st joint slightly longer than total length of following joints; 2nd to 9th joints trapezoidal, each joint smaller than preceding joints, all without basal spines; 2nd to 8th joints with long bristles with stout spines along outer margin, becoming shorter, more slender, and numerous at distal end; 9th joint with 1 short and 1 long spinous bristle; all bristles without natatory hairs; distal margins of 2nd to 8th joints with comb of slender spines; tip of bristle on 2nd joint not reaching 9th joint.

The 2nd antenna shown by Müller (1894, pl. 3, fig. 35) is similar to the specimen described in this paper. Müller apparently overlooked the row of short spines along the distal margin of joints 2–8 of the exopodite.

Mandible (figs. 7*j*, *k*): Coxale endite (fig. 7*j*) bifurcate with distal spines. Basale with 7 bristles, 4 ventral, 3 dorsal. Exopodite with 2 bristles, outer bristle shorter than inner bristle and with wreaths of long hairs. Endopodite: 1st joint with 1 short and 2 long ventral

bristles terminal; 2nd joint with 1 short dorsal bristle proximal to middle, 3 dorsal bristles near middle, 1 short ventral bristle distally, and 2 short terminal bristles near ventral margin; end joint (fig. 7*k*) with 3 bristles and 2 claws, 1 of latter very long, other about 3rd length of long claw. Terminal end of 1st endopodite joint with spines in row.

The mandible of the species illustrated by Müller (1894, pl. 3, fig. 51) has only 2 ventral bristles distally on the 1st endopodite joint, only 2 dorsal bristles in the distal group on the 2nd endopodite joint, and does not show 2 small bristles terminally on the 2nd endopodite joint or a small centrally located terminal bristle on the end joint. These were probably overlooked by Müller.

Maxilla (fig. 71 *m*): Precoxale endite with 3 stout pectinate spines and 2 bristles. Coxale endite with 2 pectinate spines and 2 bristles. Distally of coxale endite a short lobe with 3 bristles. Basale with 1 medial bristle and 2 bristles on inner margin. Exopodite consisting of 3 lateral bristles located distally on basale. Endopodite: 1st joint with 1 subterminal and 1 terminal bristle; 2nd joint with 1 short and 2 long bristles and a slender process with annulations distally.

Müller (1894, pl. 3, fig. 49) illustrates the slender process on the end joint of the endopodite as a bristle. Although the process resembles a stout bristle, it is ringed only distally and is less tapered than a bristle would be. Müller's illustration does not have the 3 bristles I interpret as the exopodite. The specimen I examined does not have a bristle on the distal margin of the coxale, possibly it broke off during the dissection. Unfortunately the left maxilla was lost so that I had the opportunity to examine only the right maxilla.

Fifth limb (figs. 8*a-e*): First joint with 2 large teeth; proximal tooth trident with 2 or 3 bristles, forward tooth spinous on posterior margin; distal tooth bifid with small secondary tooth above base of lead tooth, forward tooth with spines on leading and posterior margins, spines larger on leading margin. Second joint prolonged distally forming long fanglike tooth followed along the inner margin by a single tooth and 2 trident teeth; posterior surface with 1 long and 1 short bristle. Third joint with 2 spinous bristles near base of 4th joint. Fourth joint hirsute with 4 or 5 bristles. Inner margin of protopodite with single endite with 1 or 2 minute bristles.

The taxonomically important inner margin of the 2nd joint with its 3 teeth is not shown in the view of this appendage illustrated by Müller (1894, pl. 3, figs. 43, 46). The fanglike tooth distally on the 2nd joint is much longer on the specimen I examined than would be suspected from examination of Müller's illustrations. Possibly shortness of that tooth in Müller's illustration is the result of foreshortening, which results when an appendage is mounted obliquely on the slide.

The 2 teeth of the 1st joint of the specimen illustrated by Müller and the one I examined are quite similar. Müller apparently interprets the 2 bristles, which I consider to be on the posterior surface of the 2nd joint, to be on the inner lobe of the 3rd joint. This is quite possible, but difficult to verify, because the suture between 2nd and 3rd joints is not visible on specimens I examined. The 4th joint illustrated by Müller (figs. 43, 46) does not have the short terminal bristle present on the specimen I examined. This may have been overlooked by Müller, or possibly the number of bristles on the 4th joint varies slightly within the species.

Sixth limb (fig. 8*f*): First endite with 2 bristles; 2nd endite with 5 bristles; 3rd endite with 4 bristles; end joint with 5 (?) bristles; single bristle in place of epipodial appendage.

The appendage illustrated by Müller (1894, pl. 3, fig. 54) is quite similar to the one I examined with the exception of bearing 8 bristles on the end joint. Since the end joint I examined belongs to an immature specimen, it is possible that it has fewer bristles; because of the position of the 6th limb on the slide, I was not able to see the end joint clearly, so it is likely that more than 5 bristles are present.

Furca (figs. 8*g–i*): Each lamella with 6 claws; claws 1, 2, 4 being stout claws, and claws 3, 5, 6 slender claws; claw 3 shorter than claw 4; each claw separated from lamella by suture; claw 1 with stout spines in row proximally on lateral margin, slender spines distally on lateral and medial margins, and 1 large spine near middle of medial margin. Remaining claws with spines along medial and lateral margins; lamella, in area of distal and proximal claws, with hairs.

Müller (1894, pl. 3, figs. 34, 53) figures a furca with the 3rd claw almost equal in length to the 4th claw. This suggests that the length of the 3rd claw may be somewhat variable within the species. Müller's figures do not show peripheral spines on claws 3, 5, 6. It seems probable that these were overlooked by Müller. In this regard, it is interesting that Brady and Norman (1896, p. 672) state that the larger furcal claws of *Pseudophilomedes inflatus* are ciliated on the edge and in the figure of this appendage (1896, pl. 59, fig. 10) show claws 3 and 8–10 without marginal spines. In view of Müller's omission of marginal spines on slender claws, it seems likely that they also were overlooked by Brady and Norman. It would be most unusual and seems quite unlikely for spines to be absent from the slender claws, especially claw 3.

Family Philomedidae Müller

Philomedinae Müller, 1912, p. 24 (part).

Type genus.—*Philomedes* Liljeborg, 1853. Gender: Masculine.

Diagnosis.—Shell: Shell variable in outline, but generally elongate

with convex dorsal and ventral margins; surface smooth or with complex ornamentation; anterior with rostrum and shallow-to-deep antennal sinus; posterior rounded or with process; lamellar prolongation of selvage with fringe of hairs.

First antenna: First joint without bristles; 2nd joint with 1 distolateral bristle, 1 distodorsal bristle, and usually 1 distoventral bristle; 3rd joint with 1 ventral and 1–4 dorsal bristles; 4th joint with 1–4 distoventral and 1–2 distodorsal bristles; 5th joint of male considerably reduced but always represented ventrally by a sensory bristle broadening proximally and with numerous long filaments; 5th joint of female not reduced, and with a stout distoventral bristle with short filaments; 6th joint of male not reduced, and with a slender distomedial bristle; 6th joint of female considerably reduced but always with a slender distomedial bristle; 7th joint reduced, and with 1 short distodorsal bristle, 1 long distomedial bristle with short filaments, and 1 long distoventral bristle with filaments (a-, b-, and c-bristles respectively); 8th joint reduced and with 2 long bare distolateral bristles (d- and e-bristles), and 2 long distomedial bristles with filaments (f- and g-bristles); c- and f-bristles on male extremely long, about length of shell.

Second antenna: Endopodite of male with 3 joints, each joint with 2 or more bristles; endopodite of female with 1–3 joints having total of 6 or more bristles. Exopodite: 3rd joint of male at least twice length of 2nd joint; in female joints decreasing in length distally; joints usually with basal spines; 2nd to 8th joints each with 1 bristle; 9th joint usually with 6–7 bristles.

Mandible: Coxale in female large, bifurcate at tip, in male reduced or absent. Basale with 5–9 ventral bristles, 1–4 dorsal bristles, and 5–6 medial bristles. Exopodite elongate with 2 terminal bristles. Endopodite: 1st joint with 4–7 ventral bristles; 2nd joint with 5 or more dorsal bristles and ventrally at least 1, but usually about 6 bristles. End joint with 2–3 claws and 3–4 bristles.

Maxilla: Endites 3 in number; exopodite elongate with 3 bristles; maxilla on female usually larger than on male.

Fifth limb: Exopodite: 1st joint of female with 2 or more strong teeth; 2nd joint of female forming large squarish sclerotized process having large inward projecting tooth distally and an inner margin either smooth or with small nodes or 2 large teeth; 1st and 2nd joints of male without stout teeth; 3rd joint with 3 bristles on inner lobe and 2 on outer lobe; 4th joint elongate with 5–6 bristles. Endites 3 in number with a varying number of bristles. Epipodial appendage with numerous bristles (more than 30).

Sixth limb: Endites 4 in number; end joint with 9–45 bristles; 2–4 bristles in place of epipodial appendage.

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Seventh limb: Terminus with comb opposed by 2 pegs; cleaning bristles 6–35 in number.

Frontal organ: Elongate with or without rings.

Eyes: Large medial eye. Lateral eyes in female large with numerous ommatidia, in male absent or small without numerous ommatidia.

Furca: Considerable variation in distribution of primary and secondary claws. Total number of claws 6–17; all or some claws separated from lamella by sutures.

The following genera are referred to the Philomedidae: *Philomedes* Lilljeborg, 1853: ?*Pleoschisma* Brady, 1880: ?*Tetragonodon* Brady and Norman, 1896: *Scleroconcha* Skogsberg, 1920; *Euphilomedes* Poulsen, 1962; *Paraphilomedes* Poulsen, 1962.

Euphilomedes Poulsen

Type species.—*Euphilomedes nodosus* Poulsen, 1962, by subsequent designation, Kornicker (in press). Gender: masculine.

Euphilomedes asper, new combination

Figures 9, 10, 11*a–d*, 12

Philomedes aspera Müller, 1894, pp. 210–211, pl. 3, figs. 3, 17, 21; pl. 8, fig. 1.
Philomedes foveolata.—Brady and Norman, 1896, pp. 659–661, pl. 56, figs. 4, 5.
[Not *Pseudophilomedes foveolata* Müller, 1894.]

Syntypes.—Zoological Museum of Berlin, Division of Crustacea, catalog no. 9152.

Material.—1. A glass slide in the collection of the British Museum (Natural History) labeled "*Philomedes foveolata* Bra & Nor♂" at one end of the slide and at the other end "Naples 1887"; a 3rd label bears the number 1900–3–6–452. The slide contains a dissected ostracod with parts under 6 cover slips. This slide probably contains the specimen upon which Brady and Norman (1896) based their description. Because of the poor condition of the slide, another specimen (see paragraph 2, below) was used for the description and most illustrations used in this paper. However, the appendages and carapace on Brady and Norman's slide were carefully compared wherever possible with those from the specimen I dissected. Both specimens are almost identical, but where minor differences were observed they are discussed when the appendage is described.

2. A vial in the collection of the British Museum (Natural History) containing a smaller vial with 2 whole undissected specimens in alcohol. The larger vial contains the label "*Pseudophilomedes foveolata*, Naples 1887, Norman Coll., B. M. regd. no 1911, 11.8. 36962–964." The specimens in this vial are designated in this paper

as specimens A and B. Specimen A was dissected and used in descriptions and illustrations.

3. A jar in the collection of the Zoological Museum of Berlin containing a small vial with 1 whole ostracod and 1 left and 1 right valve. The jar contains the label "Type, *Philomedes aspera* G. W. Müller, *Kat. Nr* 9152, *Fundort* Napoli." The small vial contains the label, "9152." These specimens are syntypes; Müller (1894) did not designate a holotype for the species. The whole specimen is a mature male. The left and right valves are from different specimens; their sex is unknown. I have designated the whole specimen as number 1, the right valve as number 2, the left valve as number 3, and have illustrated each valve. All specimens were returned to the Zoological Museum of Berlin in the same vial in which they were received. The whole specimen was not dissected, but as the furca was projecting from between the valves, it was possible for it to be described and illustrated in this paper.

SUPPLEMENTARY DESCRIPTION.—Shell (figs. 9*a–i;* 12*a–f*): Lateral outline oval, elongate with greatest height near middle, prominent rostrum and broad rostral incisure (figs. 9*a*, 12*a–d*); surface of valves with numerous large oval pits (fig. 9*b*). Posterodorsal margin with straight hinge; posterior hinge element of each valve consisting of angular sclerotized process; medial hinge element straight; anterior hinge element not prominent. Adductor muscle scars consisting of about 16 or 17 individual scars below middle of valve (figs. 9*e*, *i;* 12*e*). Inner lamella broadening at posteroventral process and behind rostrum (figs. 9*b*, *c;* 12*e*). Selvage with wide, corrugated, lamellar prolongation having fringe of slender spines along outer margin. Twelve to 14 bristles forming row on inner lamella behind rostrum (figs. 9*b*, *f;* 12*d*); inner lamella below rostrum with small hair followed by a wide space and then 10 hairs on left valve and 14 on right valve (figs. 9*d*, *h*). Posteroventral process with small hairs on inner lamella (figs. 9*c*, *g;* 12*e*); small hairs, singly or in pairs, forming row on list on posteroventral and posterior part of inner lamella (figs. 9*e*, *g*). Radial pore canals numerous but faint. Hairs with taper distributed on lateral surface of rostrum, some forming row near ventral and posterior margins of valves; additional hairs sparsely distributed on valve surface.

Muscle scars were somewhat obscured on all specimens. Four muscle scars located in the anterior part of the central muscle field of Müller's syntypes were not observed on the specimens of Brady and Norman.

Shell dimensions (in mm) are as follows:

collector	*specimen*	*greatest length*	*greatest height*	*remarks*
Brady and Norman	A	1. 34	0. 85	mature male
	B	1. 35	0. 81	" "
Müller	1	1. 30	0. 80	" "
	2	1. 28	0. 78	" "
	3	0. 94	0. 60	instar

Brady and Norman (1896, p. 659) give measurements of length as 1.6 mm and height as 1 mm for specimen BM 1900–3–6–452; because of the poor condition of the mounted specimen, I was unable to measure it.

Müller (1894, p. 211) gives the length of the male as 1.3 mm.

First antenna (fig. 9*j*): First joint with clusters of spines on medial surface; 2nd joint with clusters of hairs on medial surface, short spines projecting from ventral and dorsal margins, and distally with a dorsal, ventral, and lateral bristle; 3rd joint with clusters of hairs on medial surface and 1 ventral and 2 dorsal bristles; 4th joint with clusters of hairs on medial surface and 2 dorsal and 4 ventral bristles distally; 5th joint inferred to be inserted between 4th and 6th joints bearing sensory bristle with broad base and numerous filaments; 6th joint with medial bristle distally; end joints with 2 long stout c- and f-bristles, 1 short spinous dorsal a-bristle, and 2 long b- and g-bristles with filaments and 2 bare d- and e-bristles.

The above description of the 1st antenna differs from Brady and Norman's (1896, p. 660) in having 2 rather than 1 bristle on the dorsal margin of the 3rd joint and in having a total of 7 rather than 6 bristles on the end joint. The 1st antenna on slide no. 1900–3–6–452 containing a specimen dissected by Brady and Norman confirms the presence of 2 dorsal bristles on the 3rd joint and a total of 7 bristles on the end joint.

Second antenna (figs. 9*k*, *l*; 10*a*): Endopodite (fig. 9*k*) with 3 joints: 1st joint with 5 proximal bristles and 1 distal bristle; 2nd joint elongate with 2 bristles near middle; 3rd joint prehensile with a long slender bristle about one-third distance from proximal end of joint and 2 short bristles and about 5 crescentic ridges at distal end. Exopodite with 9 joints; 1st joint elongate with small medial spine distally; 2nd joint about one-third length of 1st with spined bristle reaching 6th joint; 3rd joint about twice length of 2nd; joints 4–9 trapezoidal, each joint smaller than preceding joint; joints 3–8 with slender basal spines and row of short hairs distally on lateral margin; bristles on joints 3–8 with natatory hairs; end joint (fig. 10*a*) with 4 long distal bristles with natatory hairs and 2 smaller mediodorsal bristles with sparse marginal hairs.

Brady and Norman (1896, p. 660) report only 3 bristles on the 1st joint of the endopodite of the 2nd antenna; however, 6 bristles are

present on this joint on slide no. 1900–3–6–452 containing a specimen dissected by Brady and Norman. The 1st endopodite joint of Philomedidae usually contains more than 3 bristles, so it is probable that Brady and Norman were unable to make an accurate count of bristles on that joint.

Mandible (figs. 10*b*, *c*): No coxale endite. Basale ventral margin with 7 subequal bristles with wreaths of long hairs, some also with short marginal spines distally; dorsal margin with 1 bristle near middle and 2 distally; subventral medial surface with 4 small proximal bristles and 1 bristle proximal to middle. Exopodite reaching about middle of 1st endopodite joint, with 2 subequal terminal bristles. Endopodite 1st joint with 2 short and 3 long distoventral bristles; 2nd joint with 3 dorsal bristles proximally, 6 dorsal bristles near middle, 2 ventral bristles subdistally and 2 long and 2 short ventral bristles distally. End joint (fig. 10*b*) with 2 large subequal claws, 1 short dorsal claw, and 4 bristles. Medial surface of basale and 1st and 2nd endopodite joints with clusters of hairs.

Maxilla (fig. 10*d*): Three endites: 1st endite with about 8 bristles; 2nd endite with about 7 bristles; 3rd endite with 1 proximal bristle and numerous distal bristles. Coxale with long plumose bristle. Exopodite with 1 short and 2 long bristles.

Fifth limb (figs. 10*e*, *g*): Epipodial appendage with about 33 bristles. Three endites with numerous bristles. Exopodite 1st and 2nd joints each with a flat, transparent, bladelike tooth and several bristles; 3rd joint with 2 stout plumose bristles on outer lobe and about 3 bare bristles on inner lobe; 4th and 5th joints with 6 bristles.

Sixth limb (fig. 10*f*): First endite with 3 bristles; 2nd endite with 1 proximal and 3 distal bristles; 3rd and 4th endites each with 1 proximal and 7 distal bristles; end joint with 14 bristles; 3 plumose bristles in place of epipodial appendage. Lateral and medial surface of end joint with clusters of hairs. Some bristles of end joint broken on specimen examined.

The description of the 6th limb given by Brady and Norman (1896, p. 660) differs from the above. The 1st endite seems to have been pulled off on Brady and Norman's dissected specimen (slide no. 1900–3–6–452), but part of 1 bristle remains to show that the endite was present. The missing 1st endite on the specimen evidently led Brady and Norman to mistakenly consider the 2nd endite to be the 1st endite, the 3rd endite to be the 4th, and the 4th to be part of the end joint. Brady and Norman described the 1st lobe [their terminology] to have 2 setae, and the 2nd lobe to have 1 lateral and 6 distal setae. The dissected specimen (slide 1900–3–6–452) actually has 1 lateral and 3 distal setae on the 1st lobe [their terminology] and 1 lateral and 7 distal setae on the 2nd lobe. The remainder of the description of

Brady and Norman conforms to the above description and describes accurately the appendage on slide 1900–3–6–452. However, Brady and Norman do not mention 2 slender bristles on the end joint; this brings the total number of bristles on this joint to 14, nor do they mention 3 bristles in place of the epipodial appendage; those bristles are present on the specimen on slide 1900–3–6–452.

Some variability was observed in the location of 2 relatively short and slender medial bristles on the margin of the end joint. These bristles occupy positions nos. 5 and 8 (counting from the posterior end of the joint) on the appendage on slide 1900–3–6–452; whereas, on specimen A dissected by the writer, these bristles occupy positions 6 and 9 on the left appendage, and 7 and 9 on the right appendage.

Seventh limb (figs. 10*j*, *k*): Four bristles of subequal length in distal group, each with 5 bells; 4 shorter bristles in proximal group, each with 3 bells (fig. 10*j*); marginal hairs not observed on bristles. Terminal comb with 9 or 10 teeth, some with basal spines and flanges; 2 subequal pegs opposing comb (fig. 10*k*).

Furca (figs. 10*i*, *l*, *m*): Each lamella with 10 or 11 claws: primary claws 1, 2, and 4, remaining claws secondary (fig. 10*l*). Secondary claw no. 3 slightly larger than claws 5 to 10 (figs. 10*i*, *m*), claws 6 to 10 about equal in length. All claws separated from lamellae. Primary claws with lateral and medial row of pointed teeth; tooth length varying only slightly in length on each claw. Secondary claws with row of spines along each margin. Clusters of long hairs medially on lamella between claws 1 to 8.

Specimen number 1 of Müller's syntypes contains 11 claws on the left lamella and 10 on the right, all other specimens examined contain 10 on each lamella. Both Müller (1894) and Brady and Norman (1896) describe their specimens as having 10 claws on each lamella.

Copulatory limbs (fig. 11*a*): Elongate terminating in 3 lobes, each lobe with 2 or more short bristles, 1 lobe with sclerotized tip.

Frontal organ (figs. 11*b*, *c*): Elongate, 2-jointed with 2nd joint tapering distally and having 2 small spines at tip.

Eyes: Medial eye large (fig. 11*b*). Lateral eyes large with about 13 ommatophores, each weakly divided by a suture into 2 parts (fig. 11*d*).

Discussion.—Differences between Brady and Norman's *Philomedes foveolatus* (Müller) and *Pseudophilomedes foveolatus* Müller are too large to be the result of sexual dimorphism. For example, each caudal lamella of Brady and Norman's specimens has 10 or 11 claws, whereas *P. foveolatus* of Müller has only 6; also, upper claws of Brady and Norman's specimens are subequal in length, whereas those on Müller's *P. foveolatus* decrease uniformly in size proximally; in addition, the 3rd claw of the furca on Brady and Norman's specimen is

about half the length of the 4th claw, but it is almost the same length of the 4th claw on *P. foveolatus*. Also, Brady and Norman's specimens have 13 to 14 medial bristles on the rostrum of the carapace compared to only 4 on *Pseudophilomedes foveolatus*. Specimens collected and described by Brady and Norman conform in every way to males of *Euphilomedes;* there is no basis for considering them to be males of *Pseudophilomedes*, which unfortunately remain unknown.

Euphilomedes asper (Müller, 1894) was described by Müller from males collected from the Bay of Naples. His description of the species mentions only the 2nd antenna, the furca, and the external morphology of the carapace; the secondary appendage of the 2nd antenna, the furca, and the outside of the carapace are illustrated. It is difficult to identify a species with certainty having so few characters for comparison. The specimens of Brady and Norman considered by me to be *E. asper* (Müller) have a carapace and secondary branch on the 2nd antenna identical to that illustrated by Müller. The furca on Brady and Norman's specimens has the same number of furcal claws as in Müller's illustration and a similar distribution of primary and secondary claws, but it differs in one respect: the 3rd claw of *E. asper* (Müller) is slightly smaller than the 5th claw, whereas the opposite is true on Brady and Norman's specimens. The difference in size of the 3rd and 5th claws is so small in either case, I am inclined to believe that Müller's drawing of the furca is slightly inaccurate. This belief is supported by study of syntypic material of *Philomedes asper* which shows the 3rd and 5th claws to be about the same size (fig. 12*g*).

Euphilomedes sordidus (Müller, 1890) was described from females collected along the coast of northern Japan. Müller (1912, p. 26) in a key to species of *Philomedes* distinguished *P. asper* from *P. sordidus* by the size relationship of the 3rd and 5th furcal claws: on *P. sordidus* the 3rd and 5th claws are about the same size, whereas, on *P. asper*, according to Müller, the 3rd claw is smaller than the 5th. This difference between the species disappears if the 3rd claw of *E. asper* is not actually smaller than the 5th, as is shown to be the case in the present paper. *Euphilomedes sordidus* was inadequately described and most appendages are unknown, so that it is difficult to distinguish it from *E. asper* on the basis of what is presently known about the species. The wide geographic separation of the two species suggests that they are probably not conspecific. The Japanese form (female) has 4 lateral and 6 distal bristles on the 7th appendage, whereas, the Gulf of Naples form (male) has 4 lateral and 4 distal bristles, but to what degree this is due to sexual dimorphism is not known. The antennal sinus of the female *P. sordidus* (Müller, 1890, pl. 25, fig. 17) may be shallower than of *P. aspera* (Müller, 1894, pl. 8, fig. 1).

Euphilomedes species

FIGURES 11*e-j*

MATERIAL.—Vial from British Museum collection containing separated left and right valves and several pieces of the soft parts of an ostracod, and also a label with the number 50002. The vial with the ostracod was in a larger vial with the label "*Pseudophilomedes foveolata* Naples—Shallow water—April 1887, formerly a slide dissected. Norman coll. 1900. 3. 6. 451." All appendages were present in the vial except the caudal furca.

DISCUSSION.—Because of the missing furca and poor condition of the valves, a complete description of the species was not attempted. A few appendages have been illustrated to show that the specimen could not belong to the genus *Pseudophilomedes* and is a female *Euphilomedes*.

No explanation is available for Brady and Norman's statement (1896, p. 660) that only males of *Philomedes foveolatus* (Müller) were collected. In order to disturb the specimen as little as possible, most illustrations were made from the original partly dissected specimen without benefit of cover glass.

DESCRIPTION (incomplete female).—Shell (fig. 11*e*): Oval, elongate, prominent rostrum, and broad rostral incisure; surface with oval pits. Endopodite of second antenna with 2 joints (fig. 11*f*): 1st joint with 1 long and 5 short bristles; 2nd joint elongate with long hirsute bristle near middle and distal bristle (distal bristle represented by stump on specimen examined). Exopodite of 2nd antenna (figs. 11*f*, *g*) with 9 joints: 1st joint elongate, joints 2–9 trapezoidal, each joint smaller than preceding joint; joints 2–8 with row of short hairs along media-distal margin; bristles on joints 2–5 with marginal spines and without natatory hairs; bristles on joints 6–8 with natatory hairs and without marginal spines; joint 9 with 4 stout bristles and 1 slender bristle, all with natatory hairs, and 2 subequal short spinous bristles (fig. 11*g*). Maxilla with 3 endites typical of genus. Fifth limb with large quadrate 2nd joint typical of genus. Sixth limb (fig. 11*h*) with 4 endites and end joint projecting posteriorly. Seventh limb (fig. 11*i*) with 6 lateral and 6 distal bristles; terminal row of teeth with 2 opposing pegs. Frontal organ 2-jointed (fig. 11*j*): 1st joint elongate; 2nd joint tapering from broad base to slender tip.

Shell dimensions: Maximum length 1.42 mm, maximum height 0.88 mm.

The structure of the endopodite of the 2nd antenna, the maxilla, and the 5th and 6th limbs clearly shows that this species does not belong in *Pseudophilomedes*. Without having the furca available, it is not possible to be absolutely certain that the species does not

belong to *Philomedes* rather than *Euphilomedes*, but the low number of cleaning bristles on the 7th limb make the latter genus the more probable.

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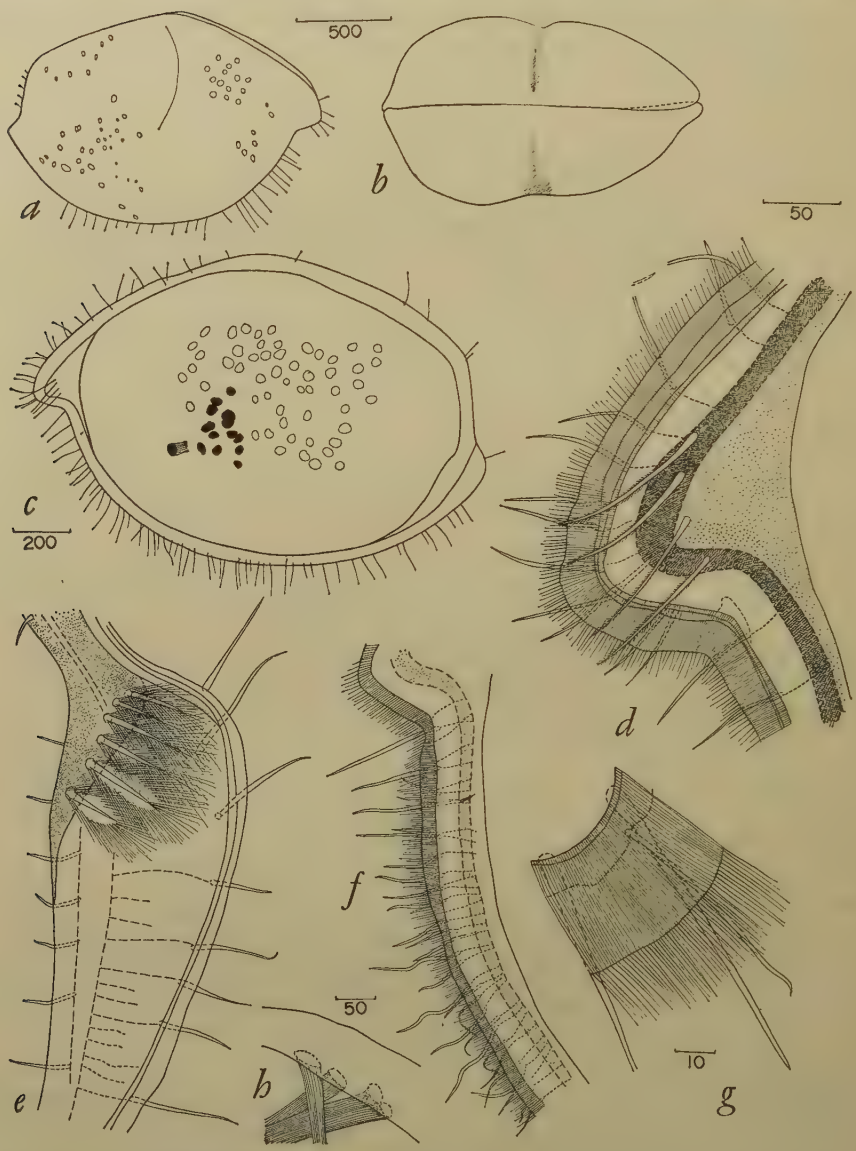


FIGURE 3.—*Pseudophilomedes ferulanus*, complete specimen: *a*, outline, all punctae not shown; *b*, dorsal view, anterior to right. Medial view, right valve: *c*, muscle scars and some punctae; *d*, anterior process; *e*, posterior process; *f*, anteroventral part; *g*, anterior margin rostrum with lamellar prolongation. Medial view left valve; *h*, muscle attachments below anterodorsal corner. (Scale same, in microns: *a*, *b*; *c*; *d*, *e*; *f*, *h*; *g*. Spec. 1, BST Sta. 30.)

FIGURE 4.—*Pseudophilomedes ferulanus*, 1st antenna: *a*, right; *b*, distal end, 5th and end joints, left; *c*, ciliated bristles on end joints; *d*, tips of closely ringed e- and d-bristles on end joint. 2nd antenna: *e*, medial view; *f*, endopodite. Mandible: *g*, lateral view; *h*, coxale; *i*, distal part. (Same scale, in microns: *a*, *e*, *g*; *b–d*, *f*; *h*, *i*. Figs. *a*, *c–i* from spec. 1, BST Sta. 30; fig. *b* from spec. 2, same station.)

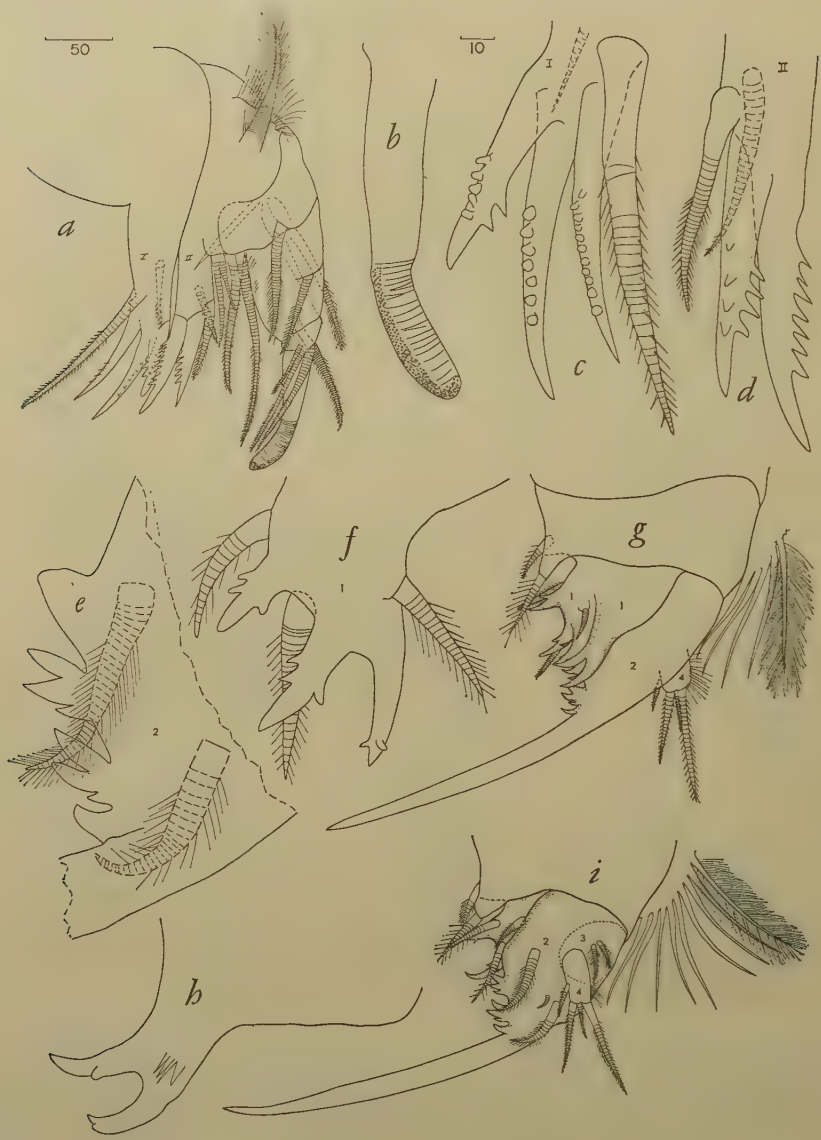


FIGURE 5.—*Pseudophilomedes ferulanus*, maxilla: *a*, left; *b*, distal process of right, anterior to left; *c*, 1st endite, anterior to left; *d*, 2nd endite, anterior to left. 5th limb: *e*, anterior view, part of 2nd joint; *f*, trident tooth on 1st joint; *g*, anterior view, distal part, only 1 bristle of epipodial appendage shown with hairs; *h*, bifid tooth on 1st joint; *i*, posterior view, distal part, only 1 bristle of epipodial appendage shown with hairs. (Same scale, in microns: *a*, *g*, *i*; *b–f*, *h*. Figs. *a–f*, *h* from spec. 1, BST Sta. 30; figs. *g*, *i* from spec. 4, same station. Roman numerals on *a*, *c*, *d* refer to endites; arabic numbers on *e–g*, *i* refer to joints.)

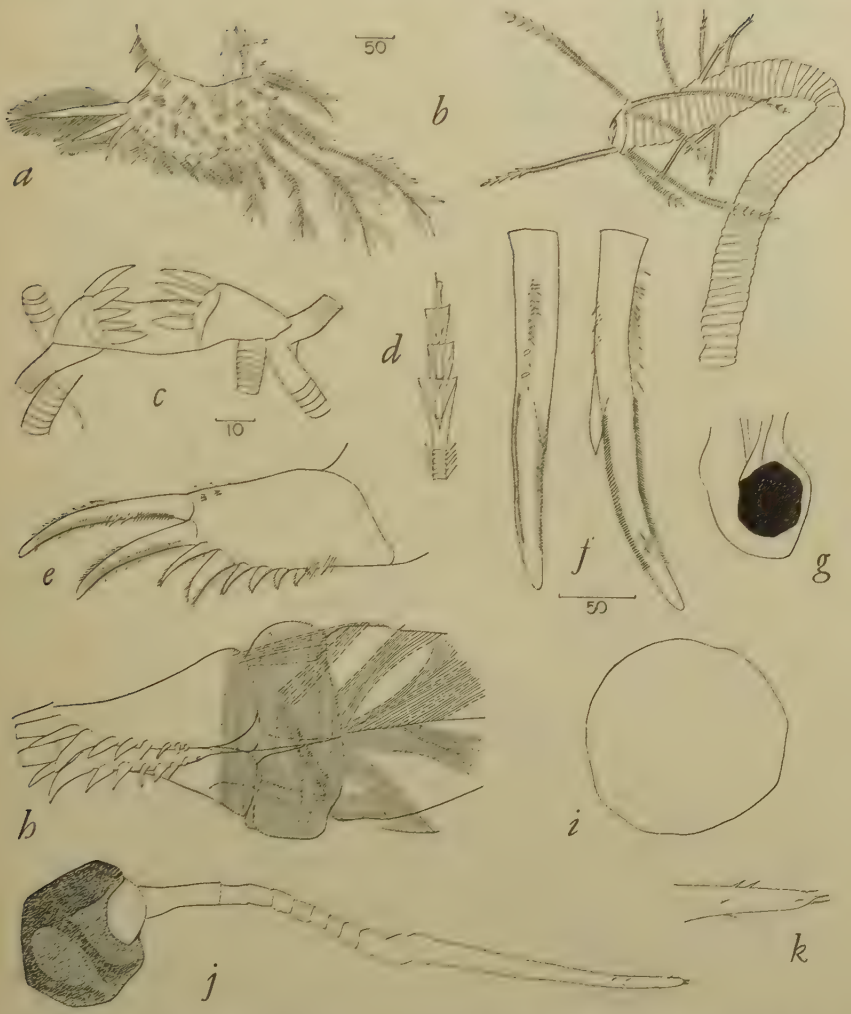


FIGURE 6.—*Pseudophilomedes ferulanus*: *a*, 6th limb; *b*, 7th limb; *c*, distal part of 7th limb; *d*, bell on distal part of bristle of 7th limb; *e*, left lamella of furca; *f*, 1st claw of left and right lamellae; *g*, lateral eye; *h*, subventral view of furca showing muscles; *i*, egg from brood pouch; *j*, medial eye and frontal organ; *k*, tip of frontal organ. (Same scale, in microns: *a*, *b*, *e*, *h*, *i*; *c*, *d*, *k*; *f*, *g*, *j*. Figs. *a–f*, *h*, *i* from spec. 1; fig. *j* from spec. 4; figs. *g*, *k* from spec. 2. All from BST Sta. 30.)

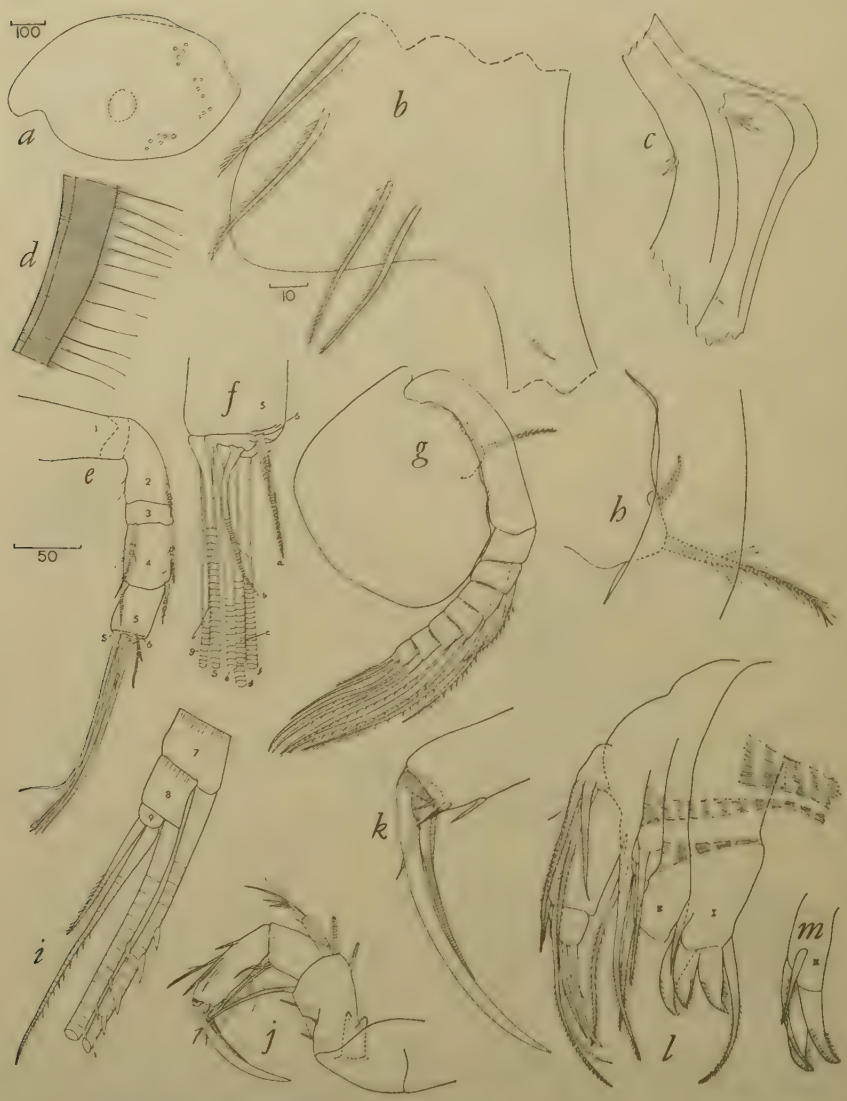


FIGURE 7.—*Pseudophilomedes foveolatus*: *a*, left view of shell, broken circle locates adductor muscles, only representative punctae shown. Medial view of valves: *b*, rostrum of right; *c*, posterior process, right; *d*, lamellar prolongation of selvage on anteroventral margin of left. Antenna: *e*, left 1st; *f*, medial view, joints 5–8 of left 1st; *g*, right 2nd; *h*, endopodite of same; *i*, lateral view, joints 7–9 of right 2nd. Left mandible: *j*, medial view, 2 outer bristles on basale broken; *k*, terminal end. Left maxilla, lateral view: *l*, bristles on endite II not shown; *m*, endite II, anterior margin to left. (Same scale, in microns: *a; b–d, f, h, i, k–m; e, g, j*. Spec. 1, BST Sta. 30.)

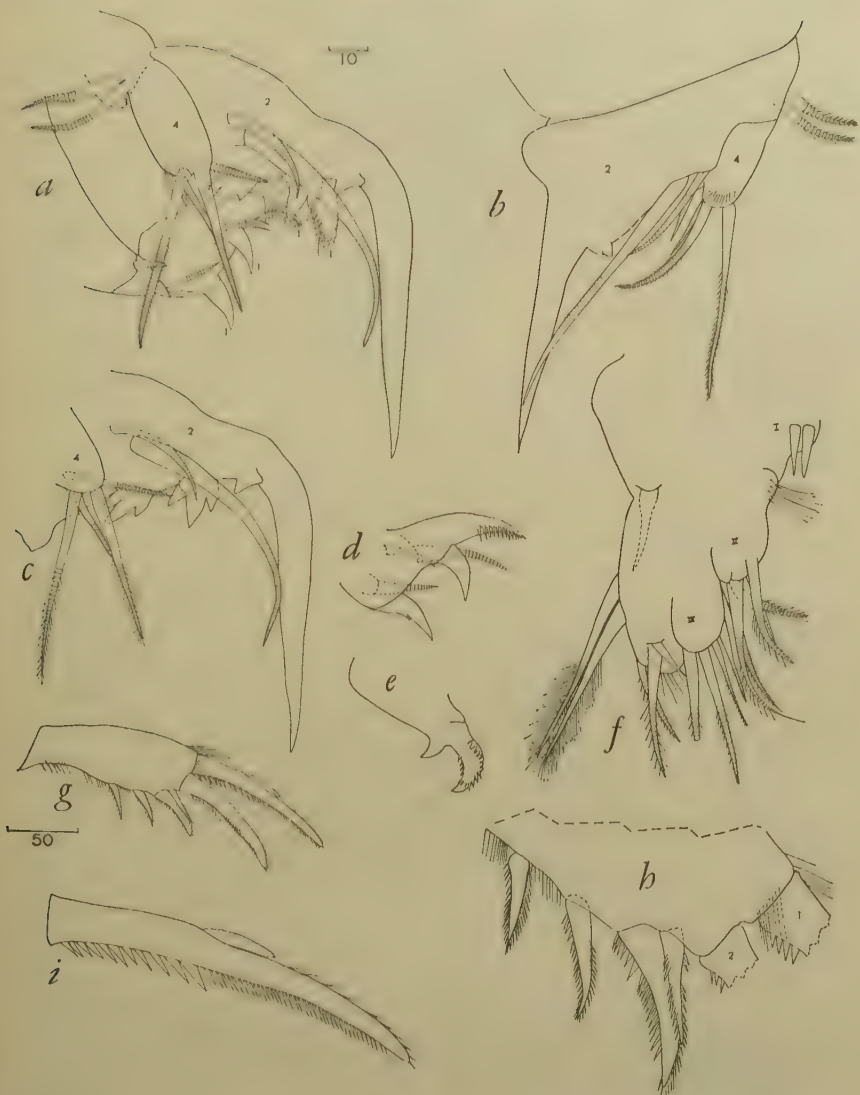


FIGURE 8.—*Pseudophilomedes foveolatus*, 5th limb: *a*, posterior view, right; *b*, oblique view from posterior of left, processes on 1st joint not shown; *c*, posterior view, right, showing only 2nd and distal part of 4th joint; *d*, posterior view, forward bifid tooth of 1st joint; *e*, posterior view, trident tooth of 1st joint. 6th limb: *f*, oblique view, right, not all bristles shown on end joint. Right caudal lamella: *g*, complete; *h*, part; *i*, lateral view, claw 1. (Same scale, in microns: *a–f*, *h*, *i*; *g*. Spec. 1, BST Sta. 30. Roman numerals on *f* refer to endites; Arabic numbers on *a*, *b*, *c* refer to joints, on *h* to claws.)

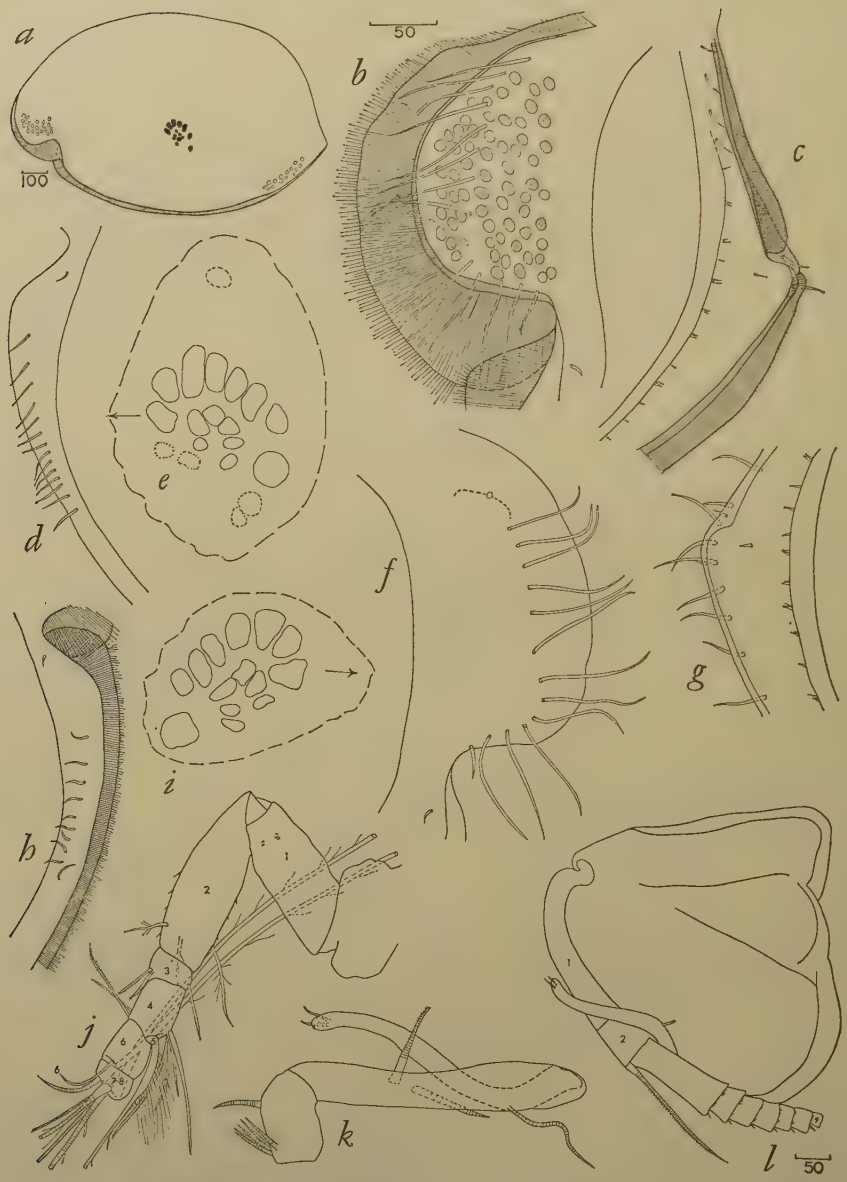


FIGURE 9.—*Euphilomedes asper*, shell: *a*, lateral outline showing muscle scars, punctae only on part of rostrum and along posteroventral margin. Medial view of valves: *b*, rostrum, right; *c*, posterior process, right; *d*, anteroventral part of inner lamella, right; lamellar prolongation of selvage not shown; *e*, muscle scars, right; *f*, rostrum, left, lamellar prolongation of selvage not shown; *g*, posterior process, left, lamellar prolongation of selvage not shown; *h*, anteroventral part of inner lamella, left; *i*, muscle scars, left. Antenna: *j*, right 1st, ends of many bristles not shown; *k*, endopodite of 2nd; *l*, lateral view, protopodite, exopodite, and joint 2 of endopodite of 2nd, bristles on joints 3–9 of exopodite not shown. (Same scale, in microns: *a; b, c, e–g, i, k; d, h, j, l.* All from spec. A.)

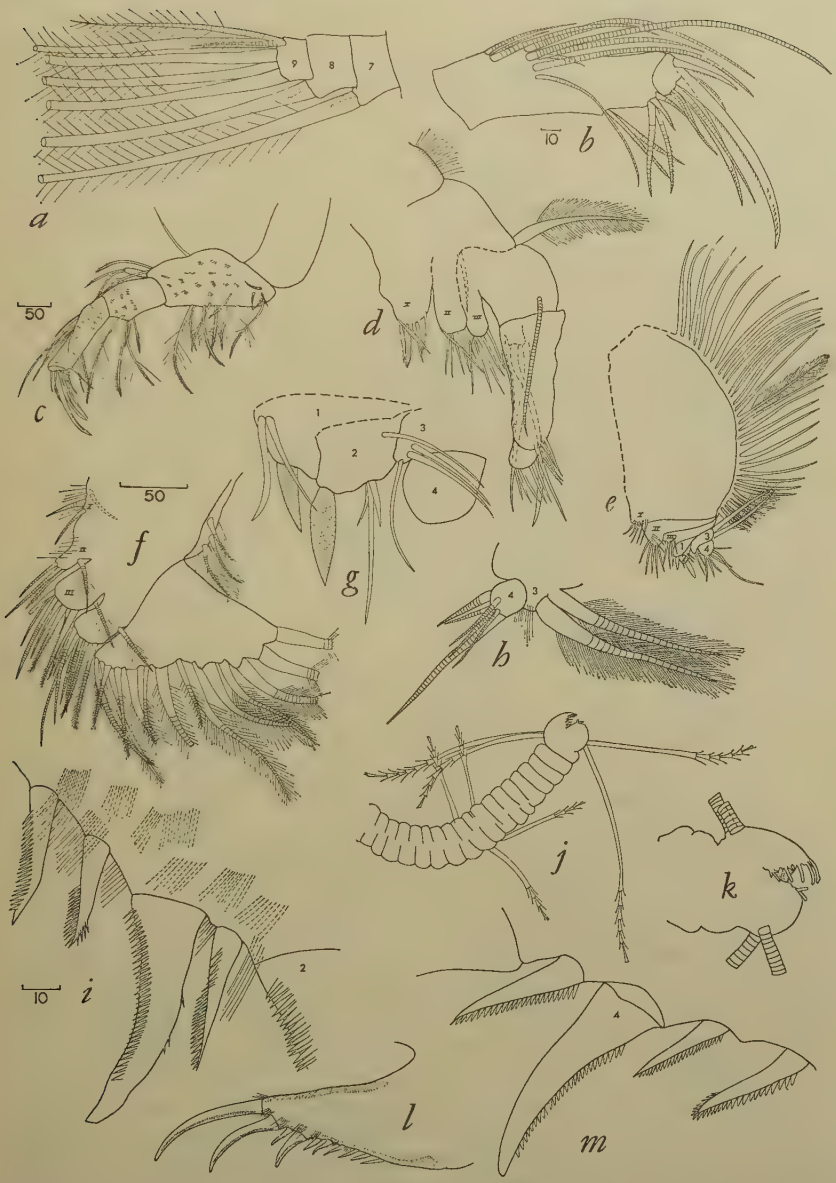


FIGURE 10.—*Euphilomedes asper: a*, medial view, joints 7–9, left 2nd antenna; *b*, lateral view, 2nd and end joints of endopodite, right mandible; *c*, right mandible; *d*, left maxilla; *e*, 5th limb; *f*, 6th limb; *g*, joints 1–4, 5th limb, all bristles not shown; *h*, 4th joint and 2 bristles on outer lobe of 3rd joint of 5th limb; *i*, claws 3–6 and part of 2nd claw of furca; *j*, distal part of 7th limb; *k*, terminal of 7th limb; *l*, left lamella of caudal furca; *m*, claws 3–6 and part of 2nd claw. (Same scale, in microns: *a, b, d, h; c, e, l; f, j; g, i, k, m*. Fig. *m* from spec. 1900–3–6–452; remaining figs. from spec. A. Roman numerals on *d–f* refer to endites; Arabic numerals on *a, g, h* refer to joints, on *i, m* to claws.)

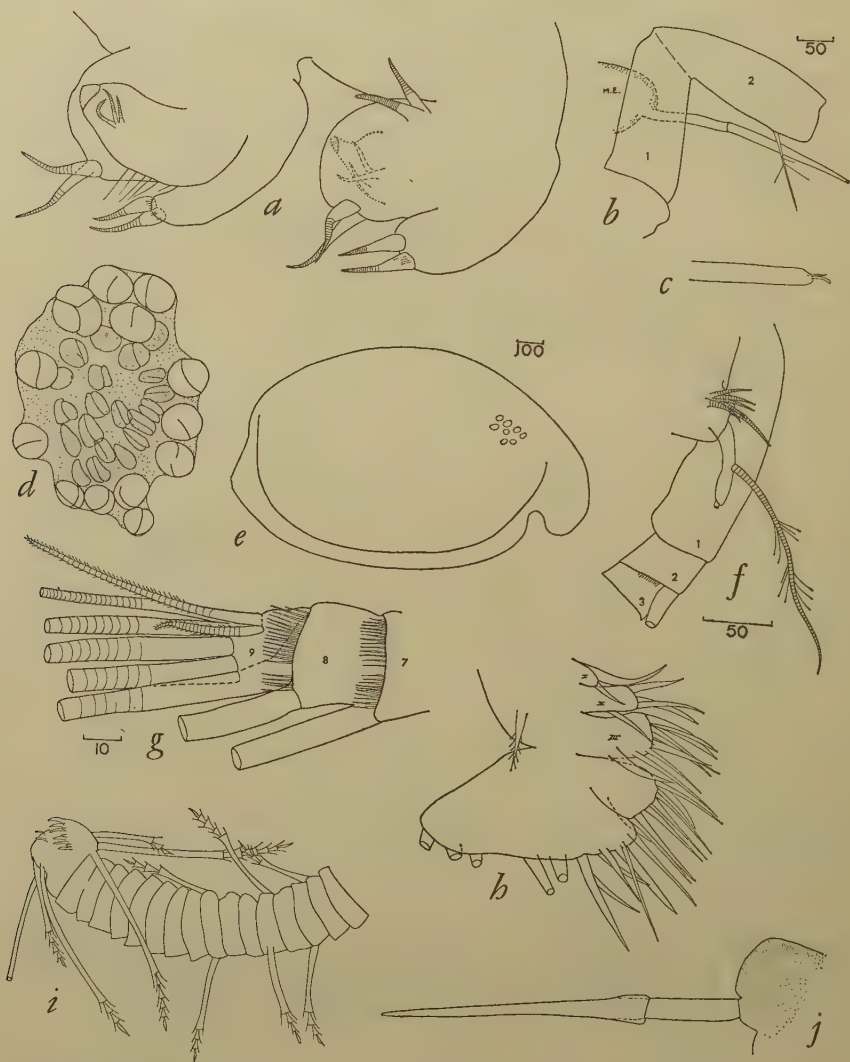


FIGURE 11.—*Euphilomedes asper: a*, copulatory appendage; *b*, frontal organ and medial eye (M. E.) with joints 1–2 of 1st antenna, all bristles on 2nd joint not shown; *c*, tip of frontal organ; *d*, lateral eye. *Euphilomedes* species: *e*, outline of left valve from inside, all punctae not shown; *f*, endopodite and joints 1–3 of exopodite of 2nd antenna, terminal bristle on 2nd joint of endopodite broken; *g*, medial view, joints 7–9, left 2nd antenna; *h*, 6th limb; *i*, distal part of 7th limb; *j*, frontal organ and medial eye. (Same scale, in microns: *a, c, g; d, f, h–j; b; e*. Figs. *a–d* from spec. A; figs. e–*j* from spec. 50002. Roman numerals on *h* refer to endites; Arabic numbers on *b, f, g* refer to joints.)

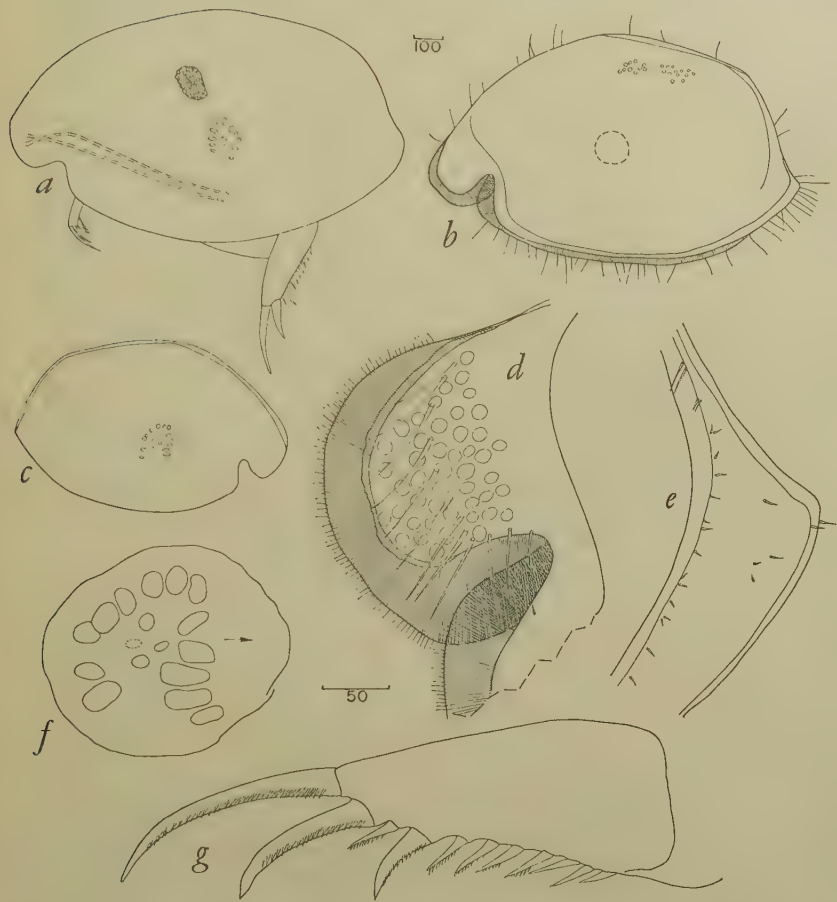
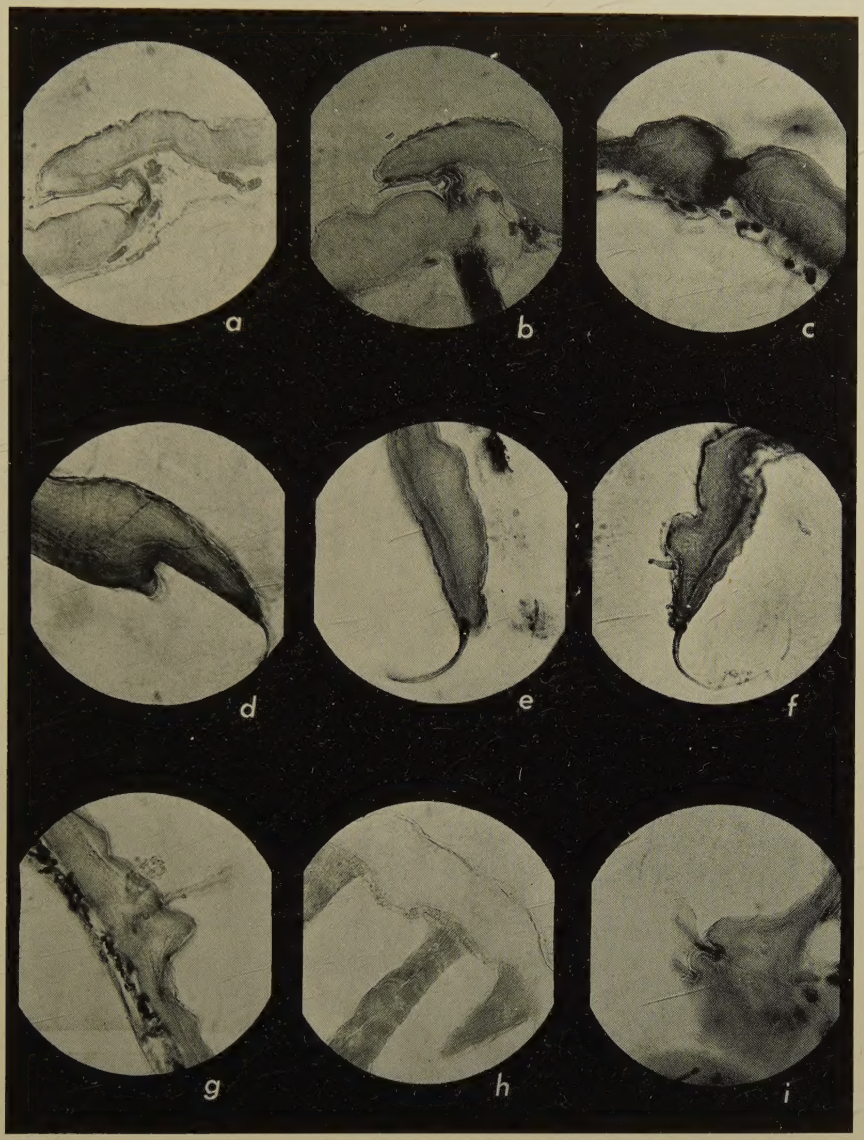


FIGURE 12.—*Euphilomedes asper*, shell: *a*, outline showing central muscle scars and lateral eye; broken lines represent c- and f-bristles. Medial view of valves: *b*, right, broken circle outlines muscle scars, small circles represent punctae; *c*, outline of left, showing muscle scars; *d*, rostrum and incisure of right; *e*, posterior process of right; *f*, muscle scars of left. Caudal furca: *g*, left lamella. (Same scale, in microns: *a–c*; *d–g*. Figs. *a*, *g* from spec. 1; figs. *b*, *d*, and *e* from spec. 2; figs. *c*, *f* from spec. 3. All are syntypes.)



Pseudophilomedes ferulanus, sections: *a*, ligament and left valve overlapping right on anterodorsal margin of carapace; *b*, ligament and muscle to median eye on dorsal margin at highest part of carapace; *c*, hinge and ligament near posterior of hinge; *d*, free margin at anteroventral part of left valve; *e*, free margin at anterodorsal part of left valve; *f*, free margin at ventral part of right valve; *g*, side of left valve showing spiral pore canal leading to hair and reticulate pattern of shell, inner lamella at left; *h*, attachment of adductor muscles on left valve; *i*, sockets of two medial bristles of caudal process. (Photographs taken with oil immersion objective, 100x.)